# *DICHANTHIUM* (POACEAE) NEW TO ARIZONA: OPEN DOOR FOR A POTENTIALLY INVASIVE SPECIES

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ABSTRACT

*Dichanthium annulatum* has become locally established in southern Arizona and is a new generic record for the state. This tenacious perennial grass is a potentially invasive species of concern and we offer specimen-vouchered documentation for its *entrada* into Arizona. There are three, simultaneous, and independent routes for its spread.

RESUMEN

*Dichanthium annulatum* se ha establecido localmente en el Sur de Arizona y es una cita de un nuevo género para el estado. Esta graminea perenne y tenaz, es una especie potencialmente invasora y ofrecemos documentación con especimenes testigo de su entrada en Arizona. Hay tres rutas simultáneas e independientes para su dispersión.

Three species of *Dichanthium*, a genus native to the Old World, have been introduced into North America as forage grasses and are established from Texas to Florida and in northern Mexico (Barkworth 2003), including Sonora: *D. annulatum* (Forsskal) Stapf, *D. aristatum* (Poir.) C.E. Hubb. (Reeder & Reeder 1998), and *D. sericeum* (R. Br.) A. Camus (Beetle & Johnston 1991). Ringed dichanthium, *D. annulatum*, is a highly variable species with a long history as a valued forage and fodder grass widely introduced in tropical and subtropical regions (Barkworth 2003; Bor 1960; Duke 1983; Reeder & Reeder 1998). It was "introduced for forage" and has become well established in thornscrub and tropical deciduous forest in southern Sonora (Reeder & Reeder 1998:504; they report it from 10 localities).

Ringed dichanthium was introduced into the Savanna Biome section inside the very large greenhouse/habitat of the Biosphere 2 near Oracle, AZ, shortly before the system was sealed in 1991 for a 2-year manned mission and then a 5-month and another 6-month mission. After the first two years people went in and out frequently. This wiry perennial is a tropical grass that is "widespread in India and Burma, and tropical and North Africa" (Bor 1960:133). It was selected for the Savanna Biome largely because it was not expected to survive the hard freezes in desert grassland at nearly 1220 meters elevation. It was grown from seeds obtained from CSIRO in Australia. Sometime after 1994, it escaped from the habitat and became established out-of-doors (Dorsi & Burgess 2003). After 1994 the Biosphere 2 campus was managed by Columbia University until they abandoned the project in summer 2004. Large numbers of people went in and out of the greenhouse prior to closure in 1991 and after it was reopened.

In 1995, Biosphere 2 was opened to tourists who passed through the Savanna area on a narrow, well-trodden trail. Tony Burgess, then a faculty member at the Biosphere 2 campus, first noted ringed dichanthium outside of the closed system in 2001. By 2003, a population of this grass had become locally established and was spreading rapidly (Dorsi & Burgess 2003). We speculate that the readily disarticulating spikelets or spikelet clusters with their long awns might have been carried outside inadvertently on shoes or clothing. During the first few years of partial opening people exiting the greenhouse had their shoe soles disinfected with Lysol for control of a nematode in the rainforest areas of the greenhouse but no control was done for pant legs, shoe tops nor socks.

The southern Sonora populations of ringed dichanthium, the only previously known ones from west of the continental divide in southwestern North America, occur in an essentially frost-free region about 620 km south of the Biosphere 2 locality. In southern Sonora and elsewhere this C-4 grass is reproductive with hot-season rains of summer and fall, and when it was introduced into the Biosphere 2 greenhouse it was presumed to be winter-spring dormant. The population sampled in June 2004 at Biosphere 2 had recently-disarticulated as well as fully-ripened spikelets, demonstrating that this species can be reproductive in late spring even at higher elevation. We also found that the plants in this population are tenaciously rooted in very hard, rocky soil and are very difficult to dig up.

In March 2005, Tom Van Devender and Ana Lilia Reina collected ringed dichanthium south of San Nicolás, Sonora, in tropical deciduous forest about 150 km north of the previous collections in the Alamos area (Reeder & Reeder 1998). It apparently was a recent arrival in 2005. They also found the grass in 2002 near Querobabi, about 380 km north of the previously known Sonora records in the non-desert southern part of the state. The northern Sonora population occurs in the Sonoran Desert in an area of presumed minimal winter-

freezing. In 2004, Tom and Ana Lilia collected an unusual grass near the Pima County Fairgrounds at the southeastern edge of greater Tucson (about 65 km south of Biosphere 2) that John Reeder identified as *Dichanthium annulatum*. In April 2005, it was discovered in Nogales just north of the Sonora border. Both the fairground and Nogales experience moderate freezes.

Ringed dichanthium has been shown to be potentially invasive in a rather wide range of environments (e.g. Duke 1983). We predict ringed dichanthium will spread widely from the three presently known Arizona sites and at the time of this writing it is probably too late to control it effectively in Arizona except by immediate and concerted effort. The northern Sonora population is also likely to spread, even to southern Arizona only 150 km to the north. Thus this newly arrived non-native perennial grass has three potential and simultaneous routes of expansion in southern Arizona and could become a seriously invasive species.

Voucher specimens: *Dichanthium annulatum*. **U.S.A. ARIZONA. Pima Co.:** W side of Tucson Kart Speedway, just W of Houghton Road (south of I-10), S part of greater Tucson; creosotebush desertscrub; 32°02'02"N, 110°47'12"W, 938 m elevation; locally abundant perennial in dense patch in roadside ditch, 21 Sep 2004, *T.R. Van Devender 2004-1093 & A.L. Reina G.* (ARIZ, ASDM, ASU, NMC, TEX) **Pinal Co.:** Columbia University Biosphere 2 Campus, E side of access road W of Biosphere 2 Savanna Biome, 32°34.692'N, 110°50.963'W, NAD 27, grass 80 cm tall, growing near roadway in elongated patch, 25 Sep 2003, *S. Dorsi I & T.L. Burgess* (ARIZ, MO, NMCR, SD, TEX, UC, US); N of Biosphere 2 Rainforest Biome, 32°34.762'N, 110°50.966'W, NAD 27, grass 60 cm tall, growing in *Dichanthium* dominated patch along railing in landscaped area with a tendency to collect runoff, 25 Sep 2003, *S. Dorsi 2 & T.L. Burgess* (ARIZ); W side of access road W of Biosphere 2 Savanna Biome, 32°34.692'N, 110°50.963' W, NAD 27, grass 50 cm tall, growing along roadway as single isolated plants, *S. Dorsi 5 & T.L. Burgess*, 25 Sep 2003 (BRIT); handicap ramp west of Biosphere 2 Savanna Biome near Savanna airlock, 32°34.701'N, 110°51.034'W, NAD 27, grass 60 cm tall, growing along walkway in dispersed patches and coexisting with other grasses, 25 Sep 2003, *S. Dorsi 4 & T.L. Burgess* (USON); Biosphere 2 Campus, W of Oracle, above Canada del Oro, 70 m E of desert biome of Biosphere 2 structure (also another small colony about 200 m to the E), ca. 3950 ft, roadside and also adjacent semi-landscaped area, ruderal landscape, rocky grassland with some shrubs; perennial with hard, knotty bases, 6 Jun 2004, *R.S. Felger 04-2, T.L. Burgess & S. Schneider* (ARIZ, ASU, RSA). **Santa Cruz Co.:** Fiesta Market on Mariposa Road, Nogales, 31°21'25"N 110°57'27"W; 1194 m elevation; common perennial on edge of pavement, 27 Apr 2005, *T.R. Van Devender 2005-731, A.L. Reina G.* (ARIZ, ASC, CAS, MEXU, NMC, TEX, US, USON). **MEXICO. Sonora: Municipio de Opodepe:** 2.6 km W of Querobabi; Plains of Sonora desertscrub; 30°03'14"N 110°03'31"W; 690 m elevation; uncommon perennial on roadside; 21 Aug 2001, *T.R. Van Devender 2001-734 & A.L. Reina G.* (ARIZ, USON). **Municipio de Yécora**: Road to La Quema on SON 117, 1.8 km S of San Nicolás junction with MEX 16; tropical deciduous forest; 28°22'11"N 109°15'42"W; 558 m elevation; locally abundant perennial on roadside, 18 Mar 2005, *T.R. Van Devender 2005-389 & A.L. Reina G.* (ARIZ, ASU, MEXU).

## REFERENCES

BARKWORTH, M.E. 2003. *Dichanthium* Willemet. In: Flora of North America Editorial Committee. Flora of North America North of Mexico, vol. 25. Oxford University Press, New York. Pp. 637–638.

BEETLE, A.A. and D. JOHNSON. 1991. Gramíneas de Sonora. Gobierno del Estado de Sonora, Secretaría de Fomento Ganadero. Hermosillo, Sonora.

Bor, N.L. 1960. The grasses of Burma, Ceylon, India and Pakistan (excluding Bambuseae). Pergamon Press, New York.

de Wet, J.M.J. and J.R. Harlan. 1968. Taxonomy of *Dichanthium* section *Dichanthium* (Gramineae). Bol. Soc. Argentina Bot. 12:206–227.

de Wet, J.M.J. and J.R. Harlan. 1970. Apomixis, polyploidy and speciation in *Dichanthium*. Evolution 24:270–277.

Dorsi, S. and T. Burgess. 2003. Spread of the exotic grass *Dichanthium annulatum* (Forssk.) Stapf at the Biosphere 2 Center, Oracle, Arizona. Unpublished manuscript, on deposit at ARIZ.

Duke, J.A. 1983. Handbook of energy crops, unpublished. www.hort.purdue.edu/newcrop/duke_energy/Dichanthium_annulatum.html (accessed February 17, 2005).

Reeder, J.R. and C.G. Reeder. 1998. Poaceae. In: P.S. Martin, D. Yetman, M. Fishbein, P. Jenkins, T.R. Van Devender, and R.K. Van Devender, eds. Gentry's Río Mayo Plants. University of Arizona Press, Tucson. Pp. 498–520.